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Will We Ever Achieve a Network Centric Navy? DoD Acquisition System Adjustments and Reforms Necessary to Bring About the Successful Migration

by
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As an Advanced Research Project

This paper was completed as an independent research project in the Advanced Research Department, Center for Naval Warfare Studies, Naval War College. It is submitted to the faculty of the Naval War College in partial satisfaction of the academic requirements for the degree of Master of Arts in National Security and Strategic Studies. As an academic study completed under faculty guidance, the contents of this paper reflect the authors' own personal views and conclusions, based on independent research and analysis. They do not necessarily reflect current official current policy in any agency of the U.S. government.

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Abstract

Information Age technology offers empowering opportunities to the organizations that can best take advantage of them. The Navy introduced network centric warfare as their Information Age concept. Unfortunately, the current acquisition system strangles initiative and precludes motivated Naval personnel from initiating network centric operations in the fleet. Further, this acquisition system will not permit the procurement of the more technically challenging network centric components needed for a true long term network centric force.

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The Author

Scot A Miller, Captain, United States Navy, graduated from the US Naval Academy in 1978 with a Bachelor of Science Degree in Operations Analysis. He was designated a Naval Aviator in December 1979. His first assignment was Patrol Squadron FORTY at NAS Moffett Field, CA, flying the P-3C Orion. He deployed three times to Misawa, Japan, with detachments to Cubi Point, RP, and Diego Garcia, BIOT.

From 1983-1986 Lieutenant Miller served as a flight instructor at Training Squadron THREE, flying the T-34C, where he logged over 1000 accident free instructional flight hours. In 1985 he was named Squadron Instructor of the Year.

In 1986 Lieutenant Miller reported aboard the USS CARL VINSON (CVN-70) in Alameda, CA as an aircraft launch and recovery officer. He also qualified and stood regular watches as a Tactical Action Officer. Lieutenant Miller deployed twice to the Indian Ocean and North Arabian Sea. From 1988-1989 Lieutenant Commander Miller served as Aide and Flag Lieutenant to the Commander, Operational Test and Evaluation Force in Norfolk, VA.

In 1990 Lieutenant Commander Miller returned to Patrol Squadron FORTY at Moffett Field, CA. He served as the Administrative, Tactics, and Maintenance Officer, and deployed to Misawa, Japan, with a detachment to Masirah, Oman in support of Operation Desert Storm. In 1994 Commander Miller was assigned as the Modeling and Simulation Officer at CINCPACFLT in Pearl Harbor, HI. He

developed modeling and simulation capabilities on board naval ships and conducted operational level analyses for various war plans.

Commander Miller reported aboard the staff of Commander, THIRD Fleet on the USS CORONADO home ported in San Diego, CA in 1997. He was the first permanently assigned Director of the Sea Based Battle Laboratory, and coordinated numerous limited objective experiments, Fleet Battle Experiment ECHO, and a Marine Corps advanced warfighting experiment. In 1999 Commander Miller became the first Director of the COMTHIRDFLT Network Centric Innovation Center. In this role he worked to improve fleet use of existing IT infrastructure.

Captain Miller holds a Masters in Business Administration from the University of West Florida (1986) and a Masters of Science Degree in Operations Analysis from the Naval Postgraduate School (1994). He is married to the former Wendy Barry of Albemarle, NC. They have one son, Jeffrey. After graduation from the Naval War College, Captain Miller is tentatively assigned as the Deputy to the Program Director for Command, Control, and Communications Systems (PD-17) for the Naval Warfare and Space Systems Command in San Diego, CA.

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Introduction: Promise and Peril

Promise

Today is an era of great change, transformation from the Industrial Age to the Information Age. While the Industrial Age, begun in late 18th century England, took several generations to come to pass, many prognosticators of the Information Age predict a rapid arrival, perhaps as short as one generation. In fact, the generation Y[1] group newly arriving into the workforce already consider themselves Information Age citizens.

The Industrial Age was all about production; specifically, the mass production of goods using assembly lines. The Industrial Age had significant social fallout; the growth of cities, the rise of labor unions, an incredible, though delayed, increase in wealth of the common man. The industrial age had nearly as many shortcomings; the pollution of the land, waters, and air of our planet, the inhumane transition of the worker into an automat, demeaning child labor, and the growth of vast urban slums.

According to many theorists, information will become, or is becoming, the coin of a new realm. Companies and organizations which use their information resources to best advantage will most likely succeed in the marketplace. Already companies like E-Bay have transformed the auction market; on line trading has

[1] According to the Consumer Electronics Association, Generation Y are the children of the Baby Boom generation and are the 70 million young adults born between 1979 and 1994. Another website offers a self defined observation that Generation Y are the "offspring of the baby boomers themselves, which leads to labels such as 'technologically savvy,' a compliment they pay us mainly for knowing the skill of VCR programming, an event that apparently elicits the same awe and excitement as the moon landing." From Dan Berman, "The Last Word," *The Trinity Reporter*, Winter 2001. <http://www.trincoll.edu/pub/reporter/W01/Berman.htm> [23 May 2001].

greatly increased participation in the stock market. Companies are striving to become knowledge-enabled, where individuals seek help online, and answers come from well-informed but unknown company colleagues from another continent. Initiatives like this greatly increase efficiency by reducing the amount of time to learn from other's experiences. Indeed, several top consulting companies, like Arthur Anderson and Pricewaterhouse Coopers, measure consultant performance by how much knowledge they contribute and how much knowledge they use from other consultants. At Pricewaterhouse Coopers it is not enough to contribute; each idea is validated through an extensive review process which certifies it as a potentially profitable addition.

Further, the Information Age will reverse the many negative trends of the Industrial Age, leading to a new golden era. Technology will reduce waiting and make new and more varied products available. Population concentrations will not become an efficiency driver for the economy, so pollution and crowding of cities will dissipate. Individuals can and will be freer to explore their desires, yet still contribute to the economy. Flexible use of time will increase, enabling higher quality family time.

The Navy has devised a new warfighting concept which matches the transition to the Information Age: network centric warfare. In much the same way that corporations have become leaner, more efficient, and yet far more effective organizations, the Navy is attempting to accomplish the same revolution by applying the lessons of Metcalfe's law:

"The cost of deploying a network increases linearly with the number of nodes in the network, the potential value of a network increases as a function of the square of the number of nodes that are connected by the network."[2]

For example, if a node costs $100, and there are five nodes, the total cost is $500. There are 20 potential connections in the network of five nodes. If another node is added, the cost increases to a total of $600, a 20 per cent increase, but the number of potential connections increases to 30, a 50 per cent increase. Imagine that every Naval war fighter is a node and the number of total connections rises as a square of the number of war fighters! If all of those people are addressing a problem, imagine the possibility for bringing that much intelligence to bear on it. Reality does not currently meet theory; having that many people trying to solve one problem would be confusing. Intelligently using networks to solve problems or fight wars will take careful thought on efficiently using the technology; nevertheless, the potential for applying increased knowledge resources is huge! In theory, network centric warfare will produce a more flexible responsive and effective force with fewer sailors. Further, each sailor will be a far more capable contributor to the mission, improving self worth and morale; the corollary is that retention and professionalism will increase. Because network centric warfare will employ near cutting edge technology and comparable organizational structures, recruit target populations will see the Navy as an outstanding starting work experience.

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[2] Robert Metcalfe is the inventor of the Ethernet protocol technology (key to email) and founder of the information technology company 3Com. See David S. Alberts et al., *Network Centric Warfare:*

Peril

The alleged miraculous transformation to the Information Age has had varied progress. As John Sealy Brown points out in his book, *The Social Life of Information,* it took 60 years from the development of the dynamo to achieve technical competence and acceptability, which started the electrification of the United States.[3] While Alvin and Heidi Toffler argue that the Information Age will occur much faster,[4] the fact remains that mechanical computing devices have been in use since the early 1900s,[5] and the first computer was built for use in World War II.[6] Given that perspective, perhaps this Information Revolution is not destined to be much different in time frame than the Industrial Revolution.

The unreliability and complexity of many information technology products is a dead give away that the Information Revolution is incomplete. Even now, experts in the use of information technology are known as "geeks", not so much for their unique social skills, but because of the inordinate amount of time they spend figuring out how this equipment and supporting software works. When computer

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Developing and Leveraging Information Superiority (Washington, DC: National Defense University Press, 1999), 250.

[3] John Seely Brown was the Chief Scientist of Xerox Corporation and the Director of their Palo Alto (CA) Research Center (PARC). PARC is known as the research center that developed most of the components of the personal computer: mouse, keyboard, and storage systems. See John Seely Brown and Paul Duguid, *The Social Life of Information* (Boston: Harvard Business School Press, 2000), 83.

[4] Alvin and Heidi Toffler, *War and Antiwar* (Boston: Little, Brown and Company, 1993), 21-22.

[5] Brown and Duguid, 86.

[6] The year 1996 marks the fiftieth anniversary of the ENIAC computer, the first large-scale general-purpose electronic computer. Built at the University of Pennsylvania's Moore School of Electrical Engineering, ENIAC is an acronym for "Electronic Numerical Integrator and Computer," but its birth lay in World War II as a classified military project known only as Project PX. The ENIAC is important historically, because it laid the foundations for the modern electronic computing industry. More than any other machine, the ENIAC demonstrated that high-speed digital computing was possible using the then-available vacuum tube technology. See Atsushi Akera and Asaf Goldschmidt, "John W.

users face a problem with information technology hardware or software and call 1-800-HELP, most users expect resolution will take many minutes if not hours. In many ways information technology is similar to 1912 automobiles. Autos then were very useful tools; nevertheless, they were undependable. Today, though, few automobile owners can tune their car, but automobile reliability renders that fact irrelevant. This suggests the Information Revolution will not occur until the technology has reached that level of reliability and ease of use.

Another important lesson can be gleaned from John Sealy Brown's book. He suggests that it is the social nature of humans to work together to accomplish the tasks at hand, whether it be at work or play, which allows them to adopt new tools.[7] The automobile example best exemplifies this idea. The growth in the reliability of automobiles was steady throughout the first half of the 20th century. As the number of automobile owners increased there grew more and more informal communities of interest that addressed automobile problems. When an electrical system failed, one would turn to a neighbor who had experienced a similar problem, and he helped resolve that problem. When his steering seemed stiff, he turned to another neighbor experienced on steering problems, and so forth. Few, if any users ever understood automobile mechanics completely, but they knew where to turn for help. Once the number of automobile owners reached a certain critical mass, people rapidly became much more comfortable in relying on the automobile.

Mauchly and the Development of the ENIAC Computer," Penn Library Exhibit, 24 January 2000, <http://www.library.upenn.edu/special/gallery/mauchly/jwmintro.htm>, [23 May 2001].

[7] Brown and Duguid, 104.

This lesson applies to our current use of information technology. In any given work environment, there are experts on network issues, some on operating systems, some on installing new software, and others familiar with how to best use the world wide web. It is only through group support and social interaction that groups of people have made information technology useful. Once the user group reaches critical mass, the use of computers and networks as daily tools of the trade, even in Naval warfare, will become the norm. The minimal innovation observed so far in the Navy indicates that critical mass has not been reached.

Implications for the Navy's Network Centric Warfare Concept

Adopting network centric warfare concepts can revolutionize the way the Navy operates in the 21st century. It can make the Navy stronger, more responsive, more efficient, and possibly, even cheaper to maintain. As the proceeding paragraphs demonstrate, it is not simply a matter of buying cutting edge information technology equipment and watching revolutionary change occur. Achieving network centric warfare requires fundamental change: in Naval doctrine, tactics, techniques, and procedures; manpower structures and supporting education and training infrastructures; and most importantly, a sea change in how we acquire the network centric force. That change must be led from a coherent and proactive implementation plan while accounting for the diverse social interactions that support the operations of our very effective Navy today. Further, the new technology may not be as robust as needed, and allowances must be made for that. Still, it is clear that a network centric Naval force has the potential to be far more effective and efficient across the full warfare spectrum.

Current Naval leaders grapple today with translating the network centric warfare concept into tenable Naval doctrine. In 1998 the Naval Warfare Development Command was established to develop and refine network centric concepts, conduct experiments using those concepts, and make recommendations based on the outcomes of those experiments. Similarly, the Navy's education and training organizations have instituted change in the way Naval personnel are educated and trained. New initiatives, such as the issuing of Palm handheld devices to all new surface warfare officers, has started the Navy towards becoming a networked organization. Distance learning capabilities have permeated throughout the fleet, giving many sailors chances to seek additional education on line without having to attend schools and giving sea based sailor opportunities at higher education.

Despite the best efforts of these many initiatives and the fine leaders overseeing them, the Navy will never achieve network centric warfare in our current state of affairs. The Navy's acquisition process cannot support the type of change necessary to achieve a network centric warfare force for two broad reasons: the current nature of the Navy's acquisition process and the nature of the network centric warfare concepts.

The Navy's acquisition process follows the Department of Defense 5000 series instructions, and receives guidance from both the Office of the Secretary of Defense and the Joint Staff. Title X of the United States Code assigns responsibility for the Navy to equip, train, and sustain Naval forces; thus the Navy's acquisition

system, although similar to all the other services, is operated independently.[8] This acquisition process consists of three major components: defining the requirements (requirements generation process); budgeting scarce resources to the individual requirements (the Planning, Programming, and Budget System [PPBS]); and managing the acquisition and lifecycle of defense systems (Acquisition Management System).

The current Navy acquisition system is platform centric. Requirements are translated into programs, which become stovepipes.[9] Success is measured by how well the program meets stated objectives. Unfortunately, until very recently, there was little to no requirement for different programs to be interoperable. Moreover, the requirements generation process is extremely parochial and platform oriented: the submariners want more submarines; the surface officers want more ships; and the aviators want more aircraft and aircraft carriers.

Additionally, the PPBS process allows little to no flexibility in the execution of authorized accounts. For example, money appropriated for operations and maintenance must be obligated within the given fiscal year; therefore, there is no motivation to save any of this money for the next year. Research and development money can be obligated over a two year period, but cannot be used for any other purpose. Further, the Joint Requirements Oversight Committee is dominated by the

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[8] The other service acquisition systems are derived from the same DoD publications and have similar problems. While this paper focuses on the Navy, the reported problems and proposed solutions would logically apply to all the services.

[9] In acquisition parlance, stovepipe refers to the actions of a program office which are narrowly focused on the program without consideration for any other program or technology, even if it might contribute to system performance or reduce system risk. Interoperability is not a characteristic of stovepiped systems.

regional Commanders-in-Chief, who through no fault of their own, have a very short term time horizon. The current acquisition process is a strait jacket that prevents network centric warfare from being realized.

There is a serious mismatch between the network centric warfare concept and the Navy's acquisition process. Network centric warfare relies fundamentally on networks. Networks are the technical hardware and software and related technologies that allow people and things to work together. Networks reside on platforms, but also are independent of them. The networks described in subsequent chapters may indeed be worldwide. Platform centric thinking has no room for such pervasive (and likely expensive) networks; networks that must be robust and reliable, as lessons from the Information Revolution suggest.

Getting from the current inflexible acquisition system to a future replete with these characteristics is a daunting task. How can the Navy's acquisition process be adjusted, in the short run, to jumpstart network centric warfare? Many aspects of network centric warfare are in play today, despite the handicaps of the acquisition system and its processes. However, these roadblocks severely hamper many fleet born initiatives and strangle many great ideas from young network centric thinking warrior. Are there solutions possible within the realm of the current acquisition system that may indeed invigorate rapid adaptation of the network centric concepts?

What long term reforms can be instituted to ensure the success of NCW? Many of the network centric warfare concepts embrace cutting edge technologies and processes that will not be realized without fundamental change in the acquisition process. These big ideas, like deployable micro sensors and pervasive

engagement grids, are an integral part of network centric warfare concepts. Answering these questions is central to ensuring the Navy can, in fact, successfully achieve a network centric force and capitalize effectively on the Information Revolution.

Before addressing these important questions, a clear understanding of what network centric warfare is and why it is important is a prerequisite. It is only from this understanding that one can derive the constituent network centric warfare components, why the current acquisition system is powerless to move forward on them, and what can be done to change this situation.

Before that analysis, the paper presents a brief perspective on other change experiences in the United States Navy. The first recounts current examples of the failure of the Navy's acquisition process to support network centric initiatives in anything but a fractious and inefficient manner. The second is the successful acquisition of robust carrier battle groups during the fiscally constrained interwar period from 1919-1939.

Chapter One: Perspective

Introduction

Before developing an understanding of network centric warfare and suggesting changes to the acquisition process that will enable network centric warfare, it is important to understand the depth of frustration felt at the fleet deck plates. Daily, innovative men and women attempt to employ network based solutions for a variety of warfighting and administrative problems. By focusing on these struggles, the types of constraints the acquisition process imposes become readily apparent. This resulting frustration spawns related problems with morale and eventually retention. Yet one positive example from the interwar years inspires optimism; that in a very similar situation, Naval leaders developed an entirely new war fighting scheme despite reduced budgets and senior officer resistance.

Unlike the bold and innovative moves made by Naval leaders in this situation, Naval leaders today are far more hamstrung by an acquisition system that remains inflexible, short sighted, and promotes stovepipes and poor cooperation. The following examples highlight stifled initiative, the morass of entrenched bureaucracy, and well-intentioned rules that become bureaucratic nightmares. Merely righting these processes within the realm of the current acquisition system would free considerable innovation and improvement, but within these examples are also the seeds of more incurable structural and bureaucratic problems.

Shipboard Software Installation

In the early 1990s forward thinking Navy ship commanding officers realized the administrative potential of installing on board a modest local area network.[10] Helped by inventive petty officers and using their own operating budgets, many commanding officers built their own networks. By the mid 1990s most ships had usable local area networks that supported administrative, maintenance, and even a number of operational functions. These local area networks used widely disparate components, and usually were not interoperable. Further, personnel transferring from one ship to another were confounded when their new ship ran a local area network with IBM based computers rather than the Apple based computers where they had honed a full set of skills. A Navy initiative called Information Technology for the 21st Century (IT-21) was initiated to address these interoperability nightmares. The program established common standards, and ensured that most Navy ships received not only a local area network, but the equipment that allowed off board email and web access as well.

Another component of this program was the establishment of the preferred products list (PPL), an effort to ensure that software introduced to ships was appropriate for the standard IT-21 configuration, satisfied a stated requirement, and met certain security characteristics. While no doubt PPL intent was noble, testing requirements led to trouble. Naturally, product testing for PPL certification was not free.

[10] Local area networks (LAN) allow computers to exchange data with one another.

For example, the Defense Advanced Research Project Agency (DARPA) developed a useful software tool known as CacheFlow. (Because IT-21 relies on satellite communications paths to support internet protocol routing, the Navy suffers many unreliable or slow data links. CacheFlow helps resolve this problem.) It satisfied a demonstrated fleet user requirement, and user demonstrations met with enthusiastic requests for the product as soon as possible. Unfortunately, the Space and Naval Warfare Systems Command (SPAWAR) did not have sufficient funding to support testing CacheFlow. When the individual contractor who developed the product for DARPA volunteered to pay the testing fee, they were refused on the grounds of self interest. Because SPAWAR established a testing requirement, but will not allow anyone else to fund it, the fleet is now without a needed capability. Unfortunately, this is not an isolated incident, but is representative of similar opportunities lost daily.

Not only does this kind of policy deprive fleet units of needed operational capability, it has a direct effect on retention and morale. Many sailors and officers become very frustrated by policies that do not allow improvements to be easily adopted. They seek employment with firms committed to necessary change.

The following actual email exchange[11] between two managers helping the fleet solve a real problem accentuates the level of frustration realized daily:

> ***Sue**: I am afraid that the news is not good as far as getting this on the approved products list. I talked to Gary in Chesapeake. That is where the CacheFlow appliance would be tested. He said that it would cost $37K to do the testing. When I heard this I thought about*

[11] Sue Patterson, <patterson@spawar.navy.mil>, "Cache Flow" [E-mail to Bob Younger <younger@spawar.navy.mil>], 30 March 2001.

what you had said about having Cacheflow help pay for some of this. ***Unfortunately vendors are not allowed to pay for the testing that would get their product on the Preferred Products List.*** *After talking to Joe from headquarters about this issue it became clear that letting vendors pay to get their products on the list was a really bad idea. Joe said that if this happened they would be flooded with vendors trying to get their products on the list. I can understand why what he said made sense. I know that this is a lot more than we had anticipated. I will await your reply, but as of right now I am not going to pursue this any further.*

Bob*: There is another related issue to the one you mention below. That is this process for IT-21 approval. The issue is the acquisition of commercial products that the fleet or others find useful. In this case it's a computer and program called CacheFlow, that essentially caches information for unreliable or slow data links*

I guess I question the logic that says vendors shouldn't be allowed to get their products approved, even at their own expense. What we end up with is a Catch-22 for vendors who have products that may be quite valuable to Fleet or other users. They can't sell their products to the Fleet unless they are on the list, but they can't get on the list because the government won't pay to do the screening; and prohibits them from paying. The 'screening' should (could) then be done by the user, the real customer, not by some agency who does not ever really use the product, but decides what gets screened and who gets on the list.

If I were a vendor with a product I thought could be valuable to a significant (that is, large enough to make it worthwhile to me) market in the Fleets, I think ***I'd consider suing the Federal government for discriminatory acquisition practices****. Just my thoughts...*

I don't have $40K though to do this. Sorry.

The Tortuous History of Collaboration at Sea, 1997-2001

The next story describes success, to a point. Frustration remains the dominant theme, as this success faces severe difficulty realizing its full potential. The IT-21 concept of 1996 became an official Navy program in 1998, complete with a program sponsor and manager. The USS Abraham Lincoln (CVN-72) became the first prototype IT-21 ship, and information technology confident leaders, all the

way up to Admiral Archie Clemins, the Commander in Chief of the Pacific Fleet, held high hopes for web based battle group operations. The finest technical support engineers worked day and night to mirror[12] the Lincoln's website ashore to enhance its operational relevance. Despite tremendous efforts, the initiative failed to realize its potential. Essentially, the Lincoln website became a document repository; useful, but not timely, and certainly not a catalyst for web based operations.

A new approach was required to make the initiative a success. Website replication,[13] different from website mirroring technology, was successfully demonstrated with encouraging results in Fleet Battle Experiment ECHO in March 1999.

An aggressive SPAWAR senior officer who observed the experiment developed a pilot program for the June 1999 deployment of the USS Chosin (CG-65). This pilot test was completely successful, so this officer teamed with Third Fleet staff members to introduce this capability aboard the entire USS John C Stennis (CVN-74) battle group (approximately eight ships). Despite only one month to install and train, the battle group deployed with this new capability, known as Collaboration at Sea (CaS), in January 2000.

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[12] Mirroring is a term used to describe copying an entire website file periodically and putting it on a different site. The advantage is that most users can access the alternate site, which is connected to the internet (in this case, the secure internet) through a larger bandwidth connection. If a user tried connecting directly to the Lincoln, they would access the website via a bandwidth constrained satellite connection. Unfortunately, just sending a file of the Lincoln's website to a mirror site was difficult given the unsettled nature of the satellite connection.

[13] Replication enables only the changes to a website to be updated to the alternate site, greatly reducing the amount of information needed to be transferred. Moreover, if the replication is interrupted by the unsettled satellite connection, the replication protocol allows the process to pick up where it left off, unlike the file copying process, which must begin anew.

The battle group achieved web based operations, as envisioned two years earlier for the Lincoln battle group, almost immediately. Improvement in situational awareness was remarkable; schedule changes were known nearly immediately, and collaboration amongst various communities of practice (e.g. gas turbine maintenance, maritime interdiction operations) mushroomed.

Tremendous success generates enthusiasm. The senior SPAWAR officer executed a comprehensive road show, delivering briefs to many of the Navy's top flag officers. The Commander in Chief of the Atlantic Fleet decided to install the capability on their next deploying battle group, and in fact all subsequent deploying battle groups deployed with the CaS capability.

The rest of the story, though, reveals continued frustration. At most 15 percent of the software capability is in use. It took over one year for the two fleet Commanders in Chief to agree on minimal standards for the common system attributes. Efforts to establish common tactics, techniques, and procedures remain incomplete. When Atlantic and Pacific Fleet ships meet in the Fifth Fleet area of responsibility, they still face challenging interoperability issues.

No formal education exists for the CaS system; training is ad hoc and on the job. This capability is supported by a skeletal crew, taken out of hide by both Fleets. There is no systems command program office designated to ensure consistent installations, maintain configuration control, or provide integrated logistics support. No program sponsorship at the Chief of Naval Operations (CNO) level exists. Subsequently, all funding directly detracts from other needy fleet users.

A dearth of motivated and innovative personnel is not the problem; in fact, nothing could be further from the truth. Numerous meetings and conferences attest to the effort devoted to capitalize on this capability. Indeed, a CaS derivation is being deployed to the Navy's closest Naval allies: Canada, Great Britain, and Australia. Instead, it is the acquisition process and its attendant lack of flexibility that stymies progress.

The Navy struggles to understand how to develop the remaining 85 percent of the capability provided by the CaS system, but many Naval personnel and consultants know exactly how to leverage that unused capability right now. The software behind CaS was developed in the late 1980s and available commercially in the early 1990s. It is robust and reliable, and utilizes centralized maintenance, a boon for ships that lack sufficient information technology skills. Yet one has to wonder, what could be done with new technology within an acquisition system that would enable its easy adaptation? For instance, the originator of this ten year old technology is now leading the way in peer to peer computing, where the network is smart enough to use the processing power of all the computers. In essence, the network is the computer.[14] One suspects the Navy is missing the boat, so to speak.

A glance at history reveals that there may be hope, nonetheless.

[14] Business Week ebiz, 46, 14 May 2001.

A Success Story: Carrier Aviation Development 1919-1939

> *"The issue facing the Navy was how best to take a nascent technology and turn it into an operational force in a climate of severe fiscal restraint."*[15]

During the interwar period the United States Navy successfully developed a robust and powerful carrier and carrier aviation force that revolutionized the nature of the United States' Naval forces and led to victory in the Pacific against Japan in World War II. Since there are parallels to the present Navy efforts at growing a network centric force, what are the defining characteristics that enabled carrier based aviation to succeed 70 years ago?

Following World War I, astute government strategists recognized that with possessions scattered across the Pacific Ocean in Guam and the Philippines, the United States would require a capable Naval force. Recognition that scouting was key to naval success and that aircraft scout more effectively than cruisers helped sell the Navy on the potential of ship based aviation. Further, aviation fever permeated the country in the 1920s. Even battleship admirals opposing Naval aviation were interested and aware of general aviation concepts. Thus most Naval leaders of the 1920s understood the potential strengths and weaknesses of aviation, much as today's admirals understand the network centric concepts and significant portions of the associated information technology.[16]

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[15] For the state of the Navy in the early 1920s, see Thomas C. Hone, Norman Friedman, and Mark D. Mandeles, *American and British Aircraft Carrier Development, 1919-1941* (Annapolis, MD: Naval Institute press, 1999), 24.

[16] Selected Navy flag officers attend a two week information technology awareness course hosted by the Naval Postgraduate School's Center for Executive Education. In the curriculum flag officers meet information technology and knowledge management visionaries from nearby Silicon Valley.

The Army inadvertently strengthened Naval aviation as well. By the early 1920s Army General Billy Mitchell pursued his dream of an independent military air arm, much like the Royal Air Force. Though the current Navy leaders at the time still believed in the validity of battleships fleets (and rightly so; in the early 1920s carrier aviation was a truly experimental idea) and many considered aviators upstarts and radicals and their community a small, specialized force, they were loathe to let the Army have any say in how this new technology might be integrated into Naval operations. They were so worried about the Army's intentions that in 1921 the Navy established the Bureau of Aeronautics (BuAer) and assigned a very competent senior officer, Rear Admiral William Moffett, as the first chief.[17] Admiral Moffett served 12 years until his death in an airship accident off the Big Sur coast. His continuity, stewardship, and steady leadership enabled the rise of the Bureau of Aeronautics, which developed all the aviation related equipment through a holistic approach (system of systems) so that it would be as integrated as possible.[18]

During the interwar period the Navy conducted annual Fleet Problems. With the commissioning of the Navy's first carrier, the USS <u>Langley</u> (CV-1), Naval aviation played an increasing role in these problems, starting in 1925 with Fleet Battle Problem III. At first sea based aircraft provided scouting and spotting missions to the mighty guns of the battleships. Over time torpedo and dive bombing and fighter support were added. Interestingly, the <u>Langley</u>, a converted collier, was designated an experimental ship, and though the <u>Langley</u> served operationally for

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[17] Clark G. Reynolds, *Admiral John H. Towers: The Struggle for Naval Air Supremacy* (Annapolis, MD: Naval Institute Press, 1991), 176.

many years, her crew also was tasked with developing the tactics, techniques, procedures, and support technology that are the bedrock of carrier operations today. For example, the landings per crash rate rose from 11.6 in 1926 to 26.7 in 1930[19] due to the improvements made by the Langley crew. In 1926 the Langley demonstrated a capability to recover 127 landings in one day, still a good day for the current generation of flattops. [20]

From 1929-1932 the budget for Naval aviation remained constant, despite the commissioning of two more aircraft carriers. Technical improvements played a key role in enabling Naval aviation to continue development despite the funding cap. For example, unforeseen improvements in aircraft technology and manufacturing techniques enabled an aircraft procurement contract to be met one year early.[21] It was similar to the effect of Moore's law on computer processors today.

Naval aviation also had friends in high places. Representative Carl Vinson of Georgia was impressed with the contribution of Naval aviation to the Fleet Problems, as were many opened minded battleship admirals. Proponents of Naval aviation felt they could argue their case on the merits of the contributions.

These pioneers faced minimal funding support, resistance to change, and frequently put their careers on the line (not to mention their lives; many aviators died in accidents and most suffered at least one accident). Yet they did several

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[18] Reynolds, 225.
[19] Reynolds, 205.
[20] Hone, Friedman, and Mandeles, 42.
[21] Reynolds, 226.

things right. They established a bureaucracy early in the effort and installed a savvy senior officer to grow it for 12 years, providing critical continuity. They developed some quick wins (the first trans-Atlantic flight was conducted by Navy seaplanes in 1919),[22] the community stayed focused and connected (a BuAer newsletter ensured no department was surprised by another's actions), and they stood up for what they believed in (and most of the time were right). They experimented with tactics, aircraft types, operational concepts, and weapons almost constantly. Finally, they encouraged vigorous debate both amongst the Naval aviation community and within the Navy in general, especially with the Naval War College.[23]

Final Thoughts

The current acquisition process supports innovation very poorly. Difficulties with the transfer of money continues to frustrate innovators in all services. The inability to test programs that encourage fleet migration towards network centric operations for want of a few thousand dollars seems incomprehensible. Even innovations that have been translated into official programs fail to reach their easily attainable goals due to misunderstanding and inability to gain agreement between fleets.

In the past the Navy demonstrated that they can conceptualize, test, experiment, and establish new of ways to fight, despite limited budgets and much

[22] Hone, Friedman, and Mandeles, 31.
[23] Rear Admiral William Sims initiated a process in 1919 at the Naval War College where the potential of aviation in support of the fleet was simulated at both the tactical and strategic levels. See Hone, Friedman, and Mandeles, 28.

internal opposition. As with any great change, leadership remains the primary key; with smart developers, open debate, and luck also critical.

Behavior of Naval leaders during the interwar period raises hopes that a similar approach will assist the Navy in building a true network centric force. Pessimists suggest that the Navy built a credible carrier centric force only out of dire necessity; the United States had far flung Pacific territories and a growing Japanese threat. Carriers and their air wings were the only possible technical and organizational solution. They see no such forcing function today.

Such thought is shrouded in fog. For one, Japan was an ally in World War I, and gradually emerged as a threat over a number of years. Second, new threats do exist, but current leaders have trouble seeing their final form. Is it an asymmetric threat? Weapons of mass destruction smuggled into the United States? A new peer competitor? Perhaps the strongest forcing function will be the budget. Even if President Bush and Congress agree to increase the Department of Defense budget, it is likely that increase will be spent on National Missile Defense and better pay. Therefore, the military in general and Navy in particular will have to do more with the same or decreased total obligation authority. This trend is exacerbated by the increasing age of Navy and Marine Corps platforms.

Before exploring possible solutions, it is necessary to understand what the network centric warfare concepts are in detail. Given that understanding, distilling the component pieces from those concepts is the next step. Once the concepts are translated into realizable technology requirements, it becomes far easier to identify

where the adjustments in the current acquisition system are needed, and what longer term reforms are required.

Chapter Two: Understanding Network Centric Warfare

Introduction

Network Centric Warfare is a concept, not a program, which is why there are fundamental problems moving the Navy forward to network centric warfare. Concepts just do not fit into the acquisition process. That process starts always from user requirements, but since few users fully understand the network centric warfare concepts it is difficult to jump start the acquisition process. Further, failure to deploy network centric warfare based equipment means that the users remain unexposed, creating a vicious cycle of ignorance and delays in network centric warfare fielding. Better understanding of network centric warfare is the first step to addressing this vexing problem.

This chapter sets forth the five tenets of network centric warfare in the Naval Warfare Development Command's draft document. Following each tenet is an operational example which illustrates in detail each network centric warfare concept. This tenet and example construct is designed to solidify how the tenets combine to produce an overall concept and show that seeking to migrate the Navy to the concept is beneficial. Moreover, the operational examples shed light on what might actually be needed to field a network centric force. A list of network centric warfare hardware and software requirements distilled from the network centric warfare tenets and examples follows. While by no means exact or complete, this listing serves as a critical starting point in understanding how to address the shortfalls of the acquisition process.

First tenet: Knowledge of the Adversary

> *The first tenet of network centric operations is knowledge of the adversary. This is not knowledge in terms of military capabilities (number of ships, range of guns) but knowledge of an adversary's history, politics, economics and culture. It's knowing an adversary's pressure points so the United States' military's deterrent and war fighting power can be focused to either stabilize a situation or rapidly prevail in conflict.*[24]

Operational example. The USS Bon Homme Richard (LHD-6) amphibious ready group (ARG)[25] is en route a regular rotation in the Persian Gulf. Their focus is with the countries of the Persian Gulf region, especially those countries who the ARG will join with to conduct annual exercises. As the ARG transits the Indian Ocean, an unexpected revolution begins in Bangladesh. This ARG is coincidentally nearby and able to provide rapid response. Before they act, the sailors and Marines of the ARG must know their enemy, not to mention neutral parties, and many other factors. Robust networks enable the Marine Expeditionary Unit (MEU) commander, Colonel Smith, to rapidly research all the information on the potential adversary via the web. Further, the network enables him to reach back to subject matter experts, which help him sift through all the information and translate it into actionable knowledge. Intelligent agents[26] are assigned to sort the voluminous information into easily intelligible briefs, almost automatically. Programs derived from DARPA initiatives, like the Translingual Information Detection, Extraction, and

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[24] Charles M. Martoglio, "Network Centric Operations." Description used by Naval Warfare Development Command, Newport, RI, 2000, 1.

[25] An Amphibious Ready Group consists of one large deck helicopter carrier and two smaller amphibious ships. Nominally an ARG has six Harrier V/STOL jets, 23 helicopters, and three or four air cushioned landing craft. A total of 2200 Marines, led by a Colonel, are embarked.

Summarization (TIDES), translate local newspapers and radio broadcasts automatically into English and provide computer generated analysis.

Within 24 hours Colonel Smith, previously only familiar with the Mediterranean and Persian Gulf regions, is now far more knowledgeable on the planning aspects that he needs to most be familiar with. Moreover, he has identified subject matter experts he can turn to for further analysis and country support, should it be necessary. Colonel Smith knows his knowledge of the potential adversary is incomplete. In spite of this shortcoming, he now recognizes what he does not know, which is still preferable to be just being left in the dark. Many wise commanders know that knowing what they do not know is often as important as knowing what they do know.

Derived acquisition requirements. Gaining rapid knowledge of the adversary requires a robust, reliable, and redundant force planning and coordination network and the ability to operate and maintain it. Today's unclassified and classified internet protocol networks have established a starting point. In the future, these networks must have sufficient bandwidth access for searching webs, intelligent agents to cull out and organize relevant information, and accompanying hardware that supports secure phone connections and video for reachback consultations. Both secure and unclassified networks remain a requirement.

The acquisition process focuses on the overall life cycle requirements needed that enable network systems to support the knowledge of the adversary tenet. This

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[26] Software segments designed to assist users with laborious tasks or to find out specific information are known as intelligent agents. They help filter incoming information, conduct searches for needed

implies users trained to employ these networks to their capability, and appropriate network support both afloat and ashore. Further, it requires non-material solutions, which are those usually associated with changes in doctrine, tactics, techniques, and procedures, and education and training. While those significant issues effect all these aspects, this paper focuses on acquisition adjustments and reforms necessary to move forward towards NCW. Still, building even modest networks, like IT-21, with capable users and reliable maintenance programs, has proved challenging.

Second tenet: Real-time, Shared Situational Awareness

> *The second tenet of network centric operations is real-time, shared situational awareness. It is knowing the current disposition of blue, red, and white to such a degree that an adversary's forces can be held at risk in crisis and neutralized in war. It requires an order of magnitude increase in the sensing capability possessed by the United States Navy (and all military forces). When real-time situational awareness is put into the context derived from knowledge of the adversary, a commander knows what's important to the adversary, knows where it is, and knows how to neutralize its capability.*[27]

Operational example. Continuing the ARG example, assume Colonel Smith is tasked with reconnoitering the potential area of operations and making recommendations concerning a possible opposed non combatant evacuation operation. Network centric operations allow the ARG commander to gain thorough real-time situational awareness in a number of important ways. The ARG will have its own organic sensors, whether they be manned aircraft, unmanned air vehicles (UAVs), or other types of deployable sensors. Moreover, the ARG will access non-organic sensors, such as national and spaced based assets. Additionally, already in-

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information, and an increasing number of other logical tasks. See Brown and Duguid, 2000, 36-7.
[27] Martoglio, 2.

country special forces may be able to add to his situational awareness. The key to this improved situational awareness is that he is receiving the results of his various sensors in real or near real time. Further, the awareness the commander enjoys is shared at other key nodes. Therefore, discussion related to options and potential courses of action do not suffer from confusion about the nature and deployment of the potential adversary. Everyone is working from the same data. This reduces confusion and misunderstanding between the planners and operators at the tactical and operational. This is particularly important when considering Joint operations, since terminology varies so much between the services.

In the future, situational awareness during network centric operations will be displayed using advanced technologies that capitalize on employing all the human senses and harnessing the brain's incredible conscious and subconscious processing powers.[28] Commanders and supporting planners at all nodes will have a far greater sense of the magnitude and type of threats, a clearer understanding of weaknesses, and a better understanding of the sense of time, depth, and space requisite for superior joint operational planning.

Derived acquisition requirements. A plethora of research, information technology, and life cycle acquisition requirements are necessary to gain real-time shared situational awareness. For reasons that will become evident later, a separate sensor grid/situational awareness network will be required to support this tenet. Force coordination and planning networks can endure delays in excess of time frames

[28] Bran Ferren, "Modern Fictions: How Two Big Wrong Ideas Are Blurring the Vision of Battlefield Visualization," White Paper for the Army Science Board, 1999, 3.

from several seconds to minutes, depending on the size of files being transferred and/or shared. However, the grid supporting shared situational awareness must function in real time to keep the situational picture current.

Situational awareness is derived from sensors, many more than are currently employed. Not only do both organic and non organic sensors need to be developed and acquired, but considerable effort is required to enable them to become interoperable and to contribute to various situational awareness type systems. These sensors will permeate the operational area. Considerable development, from basic research to operational testing, is needed to discern exactly how all these different sensors can be used to support a common and consistent situational awareness. Much work remains to mature these numerous sensor concepts.

Research and development in information display technologies is necessary to capitalize on the human brain's overwhelming processing power. In his book *The User Illusion*, Tors Norretrander suggests that the conscious mind communicates at about the 40 bits per second level. Experiments have proved that the subconscious mind, where a human's sensors input their information, works at an approximately ten Megabits per second rate.[29] Current systems like the Global Command and Control System (GCCS) offer many screens of information, but GCCS is non intuitive and difficult to operate. It operates by inputting data to the conscious mind at a 40 bits per second rate. Advanced displays that leverage the

[29] Tor Norretranders, *The User Illusion: Cutting Consciousness Down to Size* (New York: Penguin Books 1999), 125.

subconscious could theoretically process 25,000 times as many bits, giving the user far greater situational awareness.[30]

The other obvious requirement derived from this exceptional grid of sensors is the a magnitude of the information. Humans have templates in their subconscious for eliminating useless information. But if the sensor grid overwhelmed the human users with too much information, that grid would be useless. In fact, it might be dangerous, because it may confuse and baffle so badly as to add fog to the situation. Significant effort is required to gather, filter, and display the right information to the right operator at the right time.

Third tenet: Iterating Commander's Intent

> *The third tenet of network centric operations is "Commander's Intent." Historically, commander's intent has been a message from a battle force or battle group commander to subordinate commanders. This is one-way communication that is prone to misinterpretation, a failing that is unacceptable in network centric operations where a commander must decentralize mission execution if a dominant operational tempo is to be achieved. Commander's intent is all about engendering trust. Under network centric operations, it is a two-way, collaborative process using such vehicles as distributed collaborative planning, video-teleconferences, and networked white boards. This improves the subordinates understanding of the commander's intent since he or she is part of the planning process, new transmission mediums permit an easier, more complete transfer of commander's intent, and opportunities for dialogue exist to ensure there are no unintended ambiguities. From the commander's perspective, trust is*

[30] In one example, four senior officers visiting a research and development site of a famous entertainment company were asked to man a small ship in a room with 360 degree virtual reality. The door shut, followed immediately by deafening cannon fire, gunshots, and the glare of rockets. Marauders attacked from all quarters. Three officers responded immediately with fire, while the most senior navigated the obstacle filled channel to complete the assigned task. In just three minutes all four officers were drenched in sweat. The host's point was that without any prior instructions, the four officers instinctively observed, oriented, decided, and acted. No elaborate displays or text laden messages were available, yet the officers' awareness was quite high.

engendered since the subordinate's understanding of intent can be gauged prior to the execution of the mission.[31]

Operational example. The ARG receives an alert order; an official assignment of a mission related to the revolution in Bangladesh. Several events occur rapidly; the commander's staff develops several courses of action for their superior's approval. The commander assigns his subordinates with missions derived from the selected course of action. These are tasks that have occurred throughout the ages; keeping the boss informed while his orders are conveyed to subordinate field commanders.

In network centric operations, the common understanding of the mission, of the tasks to be accomplished, and the way it is intended to be carried out, must minimize confusion. The commander assigns helicopters to conduct reconnaissance, while V-22s insert Marines ashore near the embassy. Newly arriving naval gun fire support ships are assigned covering fire, while Harriers provide close air support.

In the past, subordinates had only a rough idea of what the other was doing, but now, because of the robust networks inherit in network centric operations, they have a clear view of how all the pieces fit together. Further, their interaction with the commander as to plan strengths and weaknesses, and discussion about alternatives builds confidence between the subordinates and the commander. Common understanding is key, because it is critical for the success of the next two tenets.

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[31] Martoglio, 3.

Derived acquisition requirements. Acquisition requirements distilled from this tenet are nearly self evident. The tenet itself describes the communications requirements necessary to support reliable and easy to obtain interaction between commanders. This robust force coordination and planning network was already defined in the first tenet. What can be said here though, is that the importance of this network cannot be understated. As retired Vice Admiral Herb Browne frequently stated about the most important characteristic of a command and control network, "It must be reliable, reliable, reliable."[32]

Again, the procurement of such a robust network is necessary but not a sufficient condition to achieve this network operations capability. It is the employment of commanders who easily employ these advanced tools. They must be raised from the start of their careers to become active users of technologies, leaders who can make the technology work for them, instead of being slaves to the technology.

One other component of network centric operations distilled from this tenet is understanding the communication of trust. The University of Arizona conducted research on the ability of newly emerging technological tools to build distance groups. The results were not encouraging. One study showed that people were far more comfortable gathering information from a stranger via high quality phone connection than via a medium quality video teleconference.[33] Apparently, there is

[32] As stated during numerous briefs while Vice Admiral Browne was the Commander, United States Third Fleet, from 1996 to 1998.
[33] Judee K. Burgoon, "Credibility, Deception Detection, and Virtual Worlds." Brief presented at National Science Foundation-Center for the Management of Information Conference December 1999, University of Arizona, Tucson.

plenty of information people gain from tonal inflections via the phone, which seem to be more useful than watching a jerky image of a person on a television screen. Since iterating the commander's intent is a trust building and group building exercise, this area needs more study.

Fourth tenet: Decentralized Execution

> *The fourth tenet of network centric operations is decentralized execution. Decentralized execution is the most efficient way to achieve dominant operational tempo. When the time involved in the sensor to shooter chain is analyzed, the majority of the time is devoted to decision making. In order to generate high operational tempo, this decision time must be reduced. Decentralizing mission execution based on subordinate's understanding of commander's intent achieves this reduction in decision time.*[34]

Operational example. Colonel Smith is assigned an opposed non-combatant evacuation operation of Americans in Bangladesh. Because he knows the adversary, has grown a shared situational awareness, and above all, iterated his intent both up and down his chain of command, he is ready to execute. Because his subordinates are well familiar with the plan and the commander's intentions, they too are ready to act. Units move into position; networks are tested; the deployable, tailorable sensor grid is in place. If perfectly executed, the operation will proceed flawlessly. Naturally, the previous sentence is false. There will always be unforeseen circumstances, and the commander does not know everything about the adversary. Because if the iterative development of the commander's intent, and the cooperative and coordinated planning, the force does have options and alternatives that add depth to their plan. When something changes, the various

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[15] Martoglio, 4.

forces can react as quickly as they need. The robust force coordination and planning network allows simple and rapid interaction between commander and subordinates to confirm adopting an alternative. Even if the situation changes drastically, the robust coordination network supports timely replanning. Finally, warfare is characterized by confusion, uncertainty, and even chaos. While network centric warfare aims to reduce these ill effects, it is still possible for a subordinate to be completely cut off. But the enhanced, iterative process for developing commander's intent still leaves the cutoff subordinate in a far better position than before network centric warfare, since the subordinate contributed more in developing the intent, and therefore has more ownership in it.

Derived acquisition requirements. The pervasive requirement derived from the fourth tenet, decentralized execution, is the heretofore rarely mentioned force control network. This network enables tactical command and control and tactical information sharing between disparate joint and allied forces. Link-16 is a current surrogate for a force control network since it is a robust network rich in critical information and devoid of the crucial time delays associated with its predecessor, Link-11 (with many tracks or nodes participating in a Link-11 network, increasing response times detract from tactical operations). Link-16's almost instantaneous control ability promises the observe, orient, decide, and act cycle[35] is not slowed unnecessarily.

[35] John R. Boyd, *A Discourse on Winning and Losing* (Maxwell AFB, AL: Air University Press, August 1987), 5.

Link-16, though, connects only a few air and surface platforms. The future force control network must include all elements of the network centric force. Unlike Link-16, it cannot be geographically constrained. This may even mean the ability to redirect unmanned combat vehicles or deployable sensors.

In terms of time delay, the force control network is in the middle. It will not be as responsive as an engagement network, where the fire control solution will be an integral part of the network, but it will be far richer in the amount and type of information being passed. Still, force control requires minimal network time delays compared to the force planning and coordination network, which is a more capable but slower network. While forerunners and prototypes of all three of these networks exist and have been in use for a number of years, in the future these three networks must interact with each other with due concern for the type and priority of the information being passed. This interoperability need adds complexity to the growth of all of these networks.

Fifth tenet: Enabling Self Synchronization

> *Decentralized execution, in turn, enables self-synchronization. Self synchronization is the coordination of activity down to the tactical unit level that is enabled by real-time, shared situational awareness, commander's intent and decentralized execution. It is individual commanders acting on their own to achieve the commander's intent while achieving coordination of action through real-time shared awareness. Complete self synchronization is a goal and, in fact, may be rarely achieved. But if friendly forces can achieve a high percentage of self synchronization (commanders acting without long decision-making time outs), then an operational tempo that overwhelms an adversary can be achieved. This is the goal of network centric operations.*[36]

[36] Martoglio, 5.

Operational example. After he gave the execute orders to his subordinates, Colonel Smith was wary, as all good commanders are when their forces intend to go into harm's way. He was cautiously optimistic, though, as events of the day would prove. He believed that his subordinate commanders understood his intent and his plan as well as he did. In fact, the iterative nature of that process improved it, he thought, as he remembered the brilliant suggestion of the battalion commander and the insights shared by Special Forces Army Captain Wood.

The force control network, newly installed just eight months prior to cruise, was working flawlessly. He knew he could have controlled the whole fight from his stateroom; he chided himself, though, not to be a micro-manager. There was no worse epithet for a Marine Corps commander. No, he was the operational commander, guiding the plan, supporting his forces, thinking about the next couple days and weeks ahead.

At the designated time, his forces began to act. All knew that the exquisitely choreographed plans developed over the last few days would never materialize; too much uncertainty still held sway. Still, each commander had a range of options and alternatives, many, in fact, ready to be triggered by the progress of their contemporaries in other zones.

Major Baker lifted off the deck of the Bon Homme Richard, leading his flight of four V-22s. His aircraft were to fly in low level across the government controlled land, and pick up the remaining Americans from the embassy. He looked at the situational awareness on his heads up display, noting that Captain's Wood's special forces were in position to take out the one surface to air missile site he was

concerned with. Lieutenant Colonel Rivera's logistics support forces had already left by LCAC to establish a secure support site and refueling area in country, ideally suited in the middle of a swamp, where no one could reach them, accessible only by hovercraft.

Unmanned air reconnaissance vehicles, in stealth mode, circled the capital, listening for any signals from the revolutionary forces. Unexpectedly a brief hint of previously unidentified revolutionary forces were picked up by one of the UAVs. Air Force Lieutenant Colonel Protho, the sensor grid coordinator on board, rapidly changed tasking for one of the UAVs, much to the relief of Major Baker.

Colonel Smith watched events unfold, and agreed with every decision of his subordinates so far. Suddenly, ground based sensors deployed the night before detected an unknown hovercraft approaching the temporary logistics base. Lieutenant Colonel Rivera's logistics force launched a rapid reaction miniature UAV from the logistics base, with the confirmation from the sensor coordinator. Identified as hostile, the forces were now in a quandary; the key refueling point for Major Baker's helicopters was at risk, jeopardizing the whole operation. The fires coordinator, Navy Lieutenant Commander McAtee, rapidly analyzed the situation; Major Baker had Hellfire laser designated missiles on board two of the V-22s, but the USS Zumwalt (DD-21), the first DD-21 ship, was in the area and capable of shooting accurate extended range guided munitions (ERGM) from its eight inch gun at moving targets, given good targeting data.

Captain Wood saved the day. He had noted on his infiltration that the area to the east was devoid of any revolutionary forces, and that Major Baker could

change his flight path easterly, saving his Hellfire for other emerging threats. LCDR McAtee saw that this would enable Zumwalt to engage the hovercraft with ERGM, almost immediately. Before even being asked, LCOL Rivera reported that the quick launch UAV could laze the hostile hovercraft immediately following notification. In less than five minutes from detection, five ERGM rounds flew towards the unsuspecting rebel hovercraft from almost 60 miles away. Their aim was true, and the V-22s refueled easily at the logistics base. Later that day, 85 scared, hungry, but happy Americans were safe on board sovereign American territory, the Bon Homme Richard.

Derived acquisition requirements. Two requirements themes emerge from this final network centric warfare tenet. First, self synchronization occurs because the first four tenets succeeded. Many times self synchronization may not be possible, even in the best of circumstances. Optimizing the probability that it can succeed means that the ways that people interact in the heat of battle must be simple. A good counter example is the use of hand-held computers in the Urban Warrior experiment of 1999 in Oakland, California. Connected wirelessly to a robust network that provided superb situational awareness and tailored intelligence reports, the hand-held computers worked effectively. As soon as the enemy fired a shot the hand-held computers were unceremoniously dumped and the Marines turned to higher priorities; seeking cover. Moreover, while the hand-held computer provided needed information, the batteries frequently died, and replacements were difficult to supply to the forward based troops. Integrating the significant potential

capability that network centric operations brings to the battlefield must be performed with the human in mind.

The second and more specific requirement gleamed from this tenet is the ability to communicate easily with the people needed. In this example, an Army Captain, Marine Corps logistics officer, Marine Corps aviator, Navy fires control officer, and Air Force sensor coordination officer, seamlessly communicated. This capability is rarely realized in today's Joint environment. Indeed, Admiral Bill Owens highlights his frustrations as Commander, Sixth Fleet in 1991 in trying to talk to the Army ashore directly form a deployed sixth Fleet ship. He commented: "We tried-*for six months*-to make the connection. And we never could link up with the Army.[37]

Final Thoughts

Implementing network centric warfare concepts offers the Navy a chance to build a responsive, powerful force. The question that arises, is network centric warfare a valid concept? Will implementation enable the Navy to meet its 21st Century challenges? If so, what do these suggested requirements mean to the current acquisition system? These questions are addressed next.

[37] William Owens, *Lifting the Fog of War* (New York: Farrar, Straw, and Giroux, 2000), 150.

Chapter Three: Justifying Network Centric Warfare and Analyzing Related Requirements

Introduction

Controversy surrounds discussion of network centric warfare concepts, as well it should. Chapter Two concludes that network centric warfare will deliver momentous change in the way Naval and Joint forces operate. Therefore acknowledging not only the benefits but the concerns with implementing network centric warfare concepts is prudent. Comparing the benefits and concerns helps establish a context in which the change to a network centric focused force can occur and improves appreciation for the issues that emerge. Ideally, this discussion will confirm why network centric warfare is in the best interests of the Navy.

If the acquisition professionals are given the network centric warfare concept as something to work towards, then how can the requirements in Chapter Two be related to the acquisition process? The last half of this chapter analyzes key traits of the proposed network centric warfare requirements generated in Chapter Two for any patterns and processes that would be addressed within the acquisition process.

The Case for Network Centric Warfare: Importance and Necessity

Network centric warfare offers a chance to approach war fighting from a direction based on the strengths of the American war fighter: independent; empowered; well trained; but with a strong sense of team. The tenets embodied in network centric warfare are not new; indeed, self synchronization is something the Army has strived for in every battle since World War I. The ability to synchronize

rapidly and efficiently, between personnel of different services, functional areas, or even coalition partners, is new; indeed, it is revolutionary.

Is network centric warfare the end all and be all for the future Navy? Or is it riddled with incorrect assumptions, flawed technical concepts, and inadequate supporting doctrine? The truth lies in between; but while network centric warfare may eliminate the fog of war, many unknowns remain. Even in Desert Storm, arguably the cleanest, least foggy war in American history, mix-ups and confusion occurred. For example, the Marines' rapid advance through Kuwait City upset the Army Corp attack plans to the west, accelerating their time schedule.[38] While the operational results were spectacular, in the long run, the confusion forced rapid war termination decisions that in retrospect were not as well considered as first believed.

Dissenters have carefully crafted insightful criticisms and warnings concerning network centric warfare, and these cannot be ignored. In a 1998 article, Colonel T. X. Hammes, USMC, argued forcefully that network centric warfare will not survive the first contact of combat.[39] Instead of deriding Colonel Hammes as a non-believer or a anti-computer advocate, it is important to understand his critique. In fact, Colonel Hammes is a well read, forward thinking Marine officer who supports the intelligent employment of new technology.[40] Nevertheless, he knows that network centric warfare must survive combat.

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[38] Michael R. Gordon and Bernard E. Trainor, *The General's War* (Boston: Back Bay Books, 1995), 361.
[39] T.X. Hammes, "War Isn't a Rational Business," *U.S. Naval Institute Proceedings*, July 1998, 23.
[40] T.X. Hammes, USMC, Fleet Marine Officer, staff, Commander, Third Fleet, interview by author, August 1998.

Professor Thomas Barnett of the Naval War College argues that network centric warfare contains "...seven deadly sins."[41] Among his arguments, he suggests that sensors will generate information overload for the operator and that network centric warfare stymies military adaptation to a world that needs military forces which ably support operations other than war.[42] There is another reason the Navy has few options with respect to network centric warfare.

In the past, citizens of the United States would not support a sizeable military for which they saw no need.[43] Despite campaign promises to the contrary,[44] the new administration appears to be following this trend. Ronald O'Rourke is a leading Naval analyst at the Congressional Research Service, and has followed Naval expenditures for 15 years. He offers four alternatives budget options for the future Naval force. Two options require additional resources, unlikely in today's political climate. Moreover, they enable only the slow growth of the status quo force. Another option maintains current budget levels, but Navy force levels would continue to dwindle as ships and aircraft reach obsolescence, adding doubt that the Navy will be able to meet all its commitments.[45] All three of these options appear "dead on arrival". Mr. O'Rourke's final option is an investment strategy based on obtaining a transformed network centric Naval force. In this option, attention is

[41] Thomas P. M. Barnett, "The Seven Deadly Sins of Network-Centric Warfare," *U. S. Naval Institute Proceedings*, January 1999, 45.
[42] Barnett, 48.
[43] After the Civil War, World War I, World War II, Korean War, Vietnam War, and Desert Storm, the Navy cut its forces significantly, sometimes by 90%. As an example, see Bart Brasher, *Implosion: Downsizing the U.S. Military, 1987-2015* (Westport, CT: Greenwood Press, 2000), 1.
[44] Roberto Suro, "Gore, Bush Defense Plans Short of Military Demands: Joint Chiefs Call for Billions More to Modernize U.S. Arsenal," *The Washington Post*, 28 October 2000, A11.
[45] Ronald O'Rourke, "Transformation and the Navy's Tough Choices Ahead," *Naval War College*

paid to the design of the overall force, and how it integrates with the networks. As Mr. O'Rourke states, "...the need now appears to be to optimize the architecture of the entire Naval force rather than simply the designs of the individual platforms that make it up."[46] It appears at best that the Navy and all the services will maintain constant or only slightly increasing resources[47], so according to Mr. O'Rourke, network centric warfare is the Navy's only viable option.

It is easy to get caught up in labels like network centric warfare and Joint Vision 2020. It is important for the Navy, however, to change focus on the way it is operated. The actual benefits that will accrue from change are important, not the buzzwords.

Putting Network Centric Warfare in Context

Strong proponents of network centric warfare, coupled with their aggressive critics, are a perfect pairing to lead the Navy as we acquire a network centric based force. Because the detractors are so concerned with network centric forces failing at the first point of contact with the enemy, or overloading operators with needless information, they will act to ensure that network centric equipment, training, and doctrine are realistically tested and judiciously deployed. Correspondingly, network centric disciples will push the Navy to realize the potential of network centric operations and prevent the critics from accidentally stopping innovation.

This tension between sides is a common characteristic of complex adaptive systems, and is an important indicator network centric warfare will serve the Navy

Review, Winter 2001, 91.
[46] O'Rourke, 101.

and the nation well. The notion of a complex adaptive system is derived from the study of chaos theory. A relatively new branch of mathematics, chaos theory attempts to explain the nature of the complex and infinite interactions between everything in the universe. A complex adaptive system is an entity, whether physical or ethereal, that acts towards one or several prime purposes. Just as a primitive cell's purpose is to live and reproduce, an organizational purpose may be to maximize profit or dominate the battlespace. Chaos theory suggests that complex adaptive systems of any kind have many similarities.

Captain George Kasten has written a brilliant article arguing that network centric operations, as he puts it, comprise a complex adaptive system with important characteristics common to all such systems. Using chaos theory, he argues that: "...the proven strength of the evolutionary process lies in its ability to test and compare all possible solutions in parallel and provide feedback of these results to the system."[48] This idea implies that the acquisition process, as a component of the network centric complex adaptive system, must respond to a continuing test and comparison process, and use this feedback to alter the overall network centric acquisition strategy.

Even more importantly, he submits that: "There will always be irreducible uncertainty about the outcomes of complex processes, but evidence <u>everywhere</u> corroborates the fact that evolutionary paths produce the best complex systems."[49]

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[47] Rick Mize, "Military May Have to Fight for Funding," *Navy Times*, 12 March 2001, 12.
[48] George Kasten. "Building a Beehive: Observations on the Transition to Network-centric Operations," *Naval War College Review*, Autumn 2000, 128.
[49] Kasten, 137.

This statement suggests that an evolutionary network centric acquisition strategy will lead to the best network centric system. Based on principles of flexibility, responsiveness, and open debate, an evolutionary path may indeed be what the Navy needs to gain an adaptive and capable network centric force. Keeping this idea of network centric warfare as a complex adaptive system helps keep focus and context on the important issues and dismiss the day to day noise.

Equating Network Centric Warfare Requirements to the Acquisition Process

Concepts are ideas; they evolve to meet new challenges. Unfortunately, concepts are not something to be acquired and maintained. Translating the network centric warfare concepts into actionable, concrete requirements is crucial before adjustments and reforms can be considered for the acquisition process. Chapter Two points to the possibility of doing just that.

Before speculating on what acquisition process adjustments and reforms are needed to acquire the list laid out in Chapter Two, it is important to consider the characteristics of those items and distinguish what common traits emerge. While there are many ways to organize the requirements, three traits stand out: degree of technical difficulty, potential cost, and degree of implementation difficulty. From an acquisition perspective, technical difficulty most impacts development and deployment, while cost drives PPBS decisions and related politics. Implementation difficulty is a crucial factor since some items will dramatically change force organization and tactics. Because these requirements are subjective and forecasted, there is no reason to grade the traits any more definitively than high, medium, and low. Table 1 shows each requirement with their graded traits. While this table is

not all inclusive, the items listed are representative of the technology types forecasted for a network centric force.

Requirement	Technical Difficulty	Potential Cost	Implementation	Total Points
Internet Protocol Based Force Coordination and Planning Network	Low 1	Medium 2	Low 1	4
Widespread Force Control Network	Medium 2	High 3	High 3	8
Deployable Micro Sensor Grids	High 3	High 3	Medium 2	8
Unmanned Combat Vehicles	High 3	Medium 2	High 3	8
Knowledge Sharing Infrastructure	Low 1	Low 1	Low 1	3
Visualization and Awareness Tools	Medium 2	Medium 2	Low 1	5
Engagement Grids	High 3	High 3	High 3	9
Point key: High=3 points, Medium=2 points, Low=1 point				

Table 1: Representative Network Centric Warfare Requirements and Associated Traits

There are seven representative requirements listed. Four of the requirements earn eight or nine points out of a possible total of nine points, indicating at least two of the three traits scored high on the degree of difficulty scale.[50] These kinds of requirements would likely have difficult acquisition issues. They are: widespread force control network; deployable micro sensor grids; unmanned combat vehicles; and engagement grids. On the other hand, three requirements score low on the degree of difficulty scale, indicating that it would be relatively easy to acquire them. They are: internet protocol based force coordination and planning network; knowledge sharing infrastructure; and visualization and awareness tools.

If requirements for network centric warfare generally break out into two groups, those that will have many difficulties being acquired, and those that appear easily acquirable today, what conclusions can be drawn about the acquisition system and network centric warfare? Chapter One highlighted the current frustration implementing relatively modest improvements in fleet operations which are network centric like. However, these efforts will continue, despite the current roadblocks of the acquisition system. Adjustments to the current acquisition process could potentially eliminate or at least reduce those roadblocks, and enable the fleet to innovate easily and effectively. Further, modifications or adjustments to the current acquisition system would enable the easy acquisition of three key network centric warfare enabling requirements identified above. If modifications would work, then the Navy could capitalize on the network centric warfare concepts sooner rather than later. Thus, when some of the above mentioned more difficult requirements do arrive, the Navy will already be network centric minded in thought and deed. Assimilation of the new, advanced technology will be far easier.

What about those difficult requirements? They are costly and employ leading edge technology that is extremely risky from a programmatic point of view. Implementing them is also quite difficult, not only because of associated training requirements, but for many doctrinal implications. For example, who controls an unmanned combat vehicle? The button pushing may be something an adroit third

[50] Admittedly, the trait grading in Table 1 is subjective in nature. It is based on the author's 27 years of Naval service and personal exposure and experience with all of the aforementioned technologies.

grade Nintendo player could do, but of what rank or experience level is the decision making and morality associated with this sort of power located?

Of the four difficult requirements for obtaining a network centric force, three are a form of network. Currently, the acquisition process is focused on platforms. It is doubtful that the current acquisition system could change its entire mindset and make networks first priority over platforms. For good reason, current program sponsors are interested in tools that reach and touch the enemy. Platforms with weapons systems; the aircraft, ships, tanks, and guns that win wars. No matter that sophisticated networks will enable greater efficiency and effectiveness in this endeavor. Networks do not kill. Networks described here will be costly, to possess the kind of reliability and robustness the critics rightly point out is needed. No, fundamental changes to the entire acquisition infrastructure are required to acquire these challenging but needed requirements.

Final Thoughts

Like it or not, it appears that striving for a Naval network centric force is the best, and perhaps only, way ahead. While critics justly point out potential network centric warfare flaws, in actuality these comments are the critical feedback required that will make network centric warfare successful. Mr. O'Rourke observes that for the Navy to continue to maintain its roles and missions, migrating towards network centric warfare is the only option.[51]

Captain Kasten points out that as a complex adaptive system, network centric warfare will migrate in the direction it is pointed. So long as the mission is

understood and the Navy continues to nurture smart and flexible leaders, network centric warfare will likely deliver the warfighting capability needed in the 21st century.

Analysis of the seven representative network centric warfare requirements derived in Chapter Two shows that they split into two groups. Three requirements appear acquirable within the confines of the current acquisition system, though as Chapter One points out, modifications or adjustments are needed. Four requirements will be difficult to acquire, because of technical issues and costs, and difficult to implement, because of fundamental doctrinal challenges. Here substantive structural reforms to the acquisition process are needed; a fundamental shift from an acquisition process focused on platforms to one focused on networks.

[51] O'Rourke, 100.

Chapter Four: Adjusting the Current Acquisition Process

Introduction

What can be done to modify or adjust the current acquisition system so that innovation and the less difficult network centric warfare requirements can be realized? Chapter One highlighted frustrations experienced daily that are attributable to the current acquisition system. To review, they were the inflexibility of the system to move money, the disastrous side effects of well intentioned rules, and the lack of structure and support for innovative ideas.

If these issues are addressed by adjusting the current system, will it be enough to satisfy the network centric warfare short term requirements: force coordination and planning network, knowledge management infrastructure,[52] and visualization and awareness tools? Will it jump start network centric operations in the Navy? These are the questions to be answered in the next few pages. First, attention must be paid to the critical aspects of the current acquisition system that will be involved in the change to a network centric Navy.

The Acquisition Process; Not All Bad

Realizing the existing and future benefits that the current acquisition process provides is important. These benefits are found in the realm of program management. From the integrated product teams, which first put together a

[52] Knowledge management is a current business buzzword that undoubtedly will pass, just as Total Quality Leadership (TQL; TQM was the business counterpart) ran its course through the Navy. Nevertheless, just as many characteristics of TQL still positively impact the Navy today, developing a Navy-wide culture of sharing good ideas and experiences using networks is the most important characteristic of the knowledge management infrastructure requirement.

program, to the lifecycle functions that sustain programs, the program manager and his or her team provide a plethora of services that sustain and improve specific programs.

Program managers sustain programs by identifying and supplying required maintenance, manpower, supply support, training and associated training devices, and support equipment. Program managers actively seek improvements to their programs during its lifecycle, and when a program reaches the end of service, ensure that disposal requirements mandated by law are satisfied.

Program managers and their staffs are acquisition professionals; most are highly trained and experienced in their fields of expertise. They add considerable value ensuring their programs meet the standards established in the operational and capstone requirements document by the requirements generation process. Newspapers articles frequently denigrate the acquisition process (the $500 hammer story stands out). Seldom do program offices receive positive press for meeting difficult deadlines or reducing costs.

Near term Acquisition Process Adjustments

Adjustments are necessary within the acquisition process to enable these dedicated program managers to help build a network centric force, rather than just build a stovepipe system. They need changes that give them an incentive for building programs that promote network centric characteristics and traits. Further, the acquisition process needs adjustment, as previously discussed, to empower the masses. How can good ideas become the foundation for future capabilities?

This section addresses needed adjustments to gain the networks and knowledge infrastructure delineated in the previous chapter. These adjustments are divided into three areas: empowering innovation; creating flexibility in funding; and challenging unintended consequences.

Empowering Innovation

The final necessary ingredient for initiating the network centric Navy is to empower Naval personnel to create innovative uses of the network centric tools and rapidly grow those ideas to benefit all fleet units. Just as in industry, the fleet operators, day in and day out, observe ways to improve the operational processes. Capitalizing on the immense pool of intellect in the fleet can rapidly improve the use of these complex tools and move the Navy forward towards networked operations.

No less an expert than Admiral Archie Clemins predicted that the true revolution derived from the establishment of an IT-21 infrastructure would come from the fleet operators.[53] Indeed, there are already many examples of such innovation. Just this year a *Navy Times* article highlighted the use of the Palm handheld computer as a grading support tool for Landing Signal Officers on board the USS Abraham Lincoln (CVN-72).[54] In 1999, two junior intelligence officers simplified the carrier based strike planning process by building a web page consisting of links to classified planning documents routinely needed for strike planning. Known as Quiver, this innovation reduced the amount of tedious

[53] Archie Clemins, "IT 21 - Moving to the Third Stage," *U.S. Naval Institute Proceedings*, May 1998, 54.

background planning from several hours to several minutes, freeing the crews to plan and rehearse more thoroughly the difficult ingress and egress phases where their aircraft would be vulnerable to enemy fire.

How can this innovation be better supported? The ideas are there, but how do they migrate to the entire fleet? Today, many ideas succeed locally, on one ship or in one squadron, but the innovator is powerless to export the idea. This may be due to their relatively junior rank, lack of money, lack of a senior advocate, or countless other reasons.

For an idea to succeed, it needs four components: 1) an operational advocate who can push the opportunity; 2) an organization that ensures associated education and training are given to all fleet users; 3) a systems command to provide program office support for installations, logistics support, and manuals; and 4) a program sponsor to provide necessary funding.

Fortunately, the Navy already as such a model in place at the Naval Strike and Air Warfare Center (NSAWC) at Fallon, Nevada. Called the Rapid Prototyping Cell (RPC),[55] this organization routinely solicits air and strike warfare commands in the Navy for good ideas. Usually fleet generated innovations have been in use for several months at the innovator's command. In essence, that unit is conducting a pilot program. Thus, the fleet innovator has already identified hardware and software requirements, training requirements, and potential ongoing support needs. He or she already knows the level of benefit the innovation provides the command.

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[54] Vivienne Heines, "Landing in the Digital Age," *Navy Times*, 26 March 2001, 22.

When the RPC convinced the NSAWC Commander of Quiver's utility, they gained an operational advocate. Second, they integrated the new product into all their strike training classes taught at NSAWC. Since all carrier air wings and associated strike planners attend school at NSAWC prior to deployment, this ensured that all subsequent deploying battle groups would use Quiver, making it the Navy standard. Next, the RPC established a memorandum of agreement with the Naval Air Systems Command (NAVAIR), in which NAVAIR agreed to provide program office support for fleet inspired innovation. Since Quiver was a software based tool, SPAWAR agreed to provide program office support. This included security testing and configuration management. Finally, the RPC arranged for the Naval aviation program sponsor on the CNO staff to provide funding.

Institutionalizing this successful process across the Navy should begin immediately. Since modest beginnings in late 1999, the RPC transitioned several more innovative concepts into fleet wide utility. They are currently working on a suite of strike planning tools that will be in fleet use by year's end.[56] What is ironic is that these tools will perform most of the processes that the Air Force's Theater Battle Management Core System (TBMCS) is intended to execute. Deployment of TBMCS, a billion dollar program, was initially expected in late 1998. The Navy awaits installation today.

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[55] Matthew Lisowski, "Rapid Prototyping Cell Point Paper," internal memorandum of the Navy Strike and Air Warfare Center, Fallon, NV, 22 May 2001, 1.

[56] Reinhart Wilke, Director, Naval Strike and Air Warfare Command Rapid Prototyping Cell, telephone conversation with author, 22 May 2001.

Challenges do remain. NSAWC was extremely fortunate in this case that the RPC, operational advocate, and educator and trainer were all collocated. Other components of the Navy may not be so fortunate. Finding the proper place to educate and train can be difficult. Most tactical education school commands operate under a rigorous set of rules, are undermanned, or both. Adding a new instruction segment is the last thing they want to accept. In this case, the operational advocate must coordinate with those school commanders and establish a win-win situation. It may be that the new training can replace something currently taught.

Another problem is finding a willing systems command. NSAWC was fortunate in that they work primarily with NAVAIR. Ships and submarines work frequently with three systems commanders: Naval Sea Systems Command (NAVSEA); SPAWAR; and Naval Supply Systems Command. NSAWC was fortunate to find a funding sponsor. In Quiver's case, costs were minimal. Other innovations may be more costly. Measuring the benefits accrued from the pilot program is important because it helps convince the program sponsors that an important fleet need can be satisfied in a cost effective manner. Unfortunately, even when program sponsors want to encourage innovation, they are frequently hamstrung when it comes to money. This lack of flexibility is addressed next.

Fighting Inflexibility, Large and Small

IT-21 was a dream of Admiral Clemins. He proposed in 1998 that the Navy fully fund the money needed to rapidly install the technology necessary to connect the fleet. Further, he believed that the IT-21 infrastructure would make the fleet

more capable and efficient in the short term and provide a catalyst for long term organizational and doctrinal growth.[57] While his dreams are playing out as he envisioned, the pace is in slow motion compared to what he foresaw. Instead of paying for IT-21 in one fell swoop, the Navy extended the program over many years. The last ship IT-21 installation is currently scheduled for 2007. What Admiral Clemins proposed to do was radical indeed, but the efficiency and effectiveness improvements just now being realized should be two to three years old by now. By accelerating IT-21 as Admiral Clemins envisioned, who knows how much the Navy would have saved. Now, with this drawn out installation process, the equipment installed on the first ships will be obsolete[58] and not interoperable with the ships that receive the final installation.

What can be done to improve flexibility? Laws associated with government spending are well intentioned; get the taxpayer the best return for his dollar. As we migrate from the Industrial Age to the Information Age, change becomes prevalent. Keeping up with new opportunities and innovations, several unthinkable just a couple years ago, requires increased flexibility in the way the Navy spends money on procuring needed requirements.

Extending the model started in the Army several years ago offers one way of greatly increasing the flexibility and spending discretion of the CNO's program sponsors. This Army approach, known as the Warfighting Rapid Acquisition

[57] Clemins, 35.
[58] According to Moore's law, the processing power of computer chips doubles every 18 months. Accordingly, ships receiving their IT-21 installation in 2007 will have 64 times the processing power of the first IT-21 ships.

Program (WRAP), was developed within the current acquisition system. For fiscal year 1998, the Department of the Army set aside $100 million for accelerating the "procurement of systems identified through warfighting experiments as compelling successes that satisfy urgent needs."[59] The Chief of Staff of the Army himself approved disbursement of the monies. WRAP's primary purpose is to support rapid prototyping of promising technologies emerging from any of the nine Army battle laboratories. An initial condition of the program was that if a battle lab applied for funding according to the established procedures, they were to be answered in no more than 30 days. An admirable requirement, it has subsequently been withdrawn. Decisions are now made every October.

The results of this effort have been mixed. It turned out that rapid prototyping is an inexact science, and results were not as successful as hoped. However, imagine broadening the program beyond the scope of just battle laboratories. If program sponsors on the CNO's staff had access to money of this magnitude, it would greatly increase their flexibility. For example, the CaS innovation was a program that rapidly gained support at the highest levels of the Navy, but remains burdened with unsupplied promise. If the program sponsor could have responded within 30 days with the approximately $3 million needed to properly execute the CaS program, the Navy would already be reaping the potential benefits CaS offers.

[59] Department of the Army, Training and Doctrine Command, *TRADOC Pamphlet 71-9*, 5 November 1999, section 13-10.

Of course, Navy budgeting is a zero sum game and establishing a WRAP-like program to improve program sponsor flexibility would subtract monies from other programs. Strong leaders willing to face difficult decisions are needed to implement this approach. No longer can the Navy fail to rapidly capitalize on innovation. Fiscal flexibility is one component that will accelerate the rewards of employing fleet generated ideas.

Challenging Unintended Negative Consequences

Chapter One cited one case where a software product known as Cache Flow could not be used by the fleet because required testing was not performed. Testing was not initiated because funding was unavailable at the systems command and rules prevented the contractor from paying for the tests. This unintended negative consequence is just one example of well-intentioned regulation makers. The rule's intent was to prevent contractors from inundating the test process with their own software, then forcing the product on the unsuspecting fleet. No one doubts the arguments for the regulation; unfortunately, this particular product provided a capability sorely needed by the fleet. What can be done to reduce the incidence of this kind of action?

This is a thorny problem. Several efforts have been tried in the past decade within the Navy to rid the fleet of duplicative and constraining rules and regulations, with some success. For example, administrative type commanders, responsible for the support and maintenance of their various platforms, have moved to drastically reduce the number of inspections. Two thoughts emerge on how to attack this problem.

First, institute a catalytic mechanism that forces change to unwanted rules and regulations. A catalytic mechanism is the brainchild of Jim Collins, a management consultant. "A simple but powerful management tool that helps organizations turn goals into results,"[60] is his definition of a catalytic mechanism. More than a slogan or motto, catalytic mechanisms "are a galvanizing, nonbureaucratic means to turn [objectives into performance]."[61] The other half of his idea is that the organization needs an audacious goal, one that the catalytic mechanism is designed to help the organization meet.

Achieving a network centric enabled Naval force by 2020 is a very ambitious goal, and worthy of an equally suitable catalytic mechanism.[62] One that Jim Collins' suggest matches seamlessly the dilemma faced by the current acquisition system in trying to eliminate the unintentional consequences of rules and regulations. That mechanism would be:

> *Waiver-of-regulations requests must be acted upon within 30 days. After 30 days, if no answer is forthcoming, the party asking for the waiver can **assume approval** and implement the waiver. Those officials with the authority to change regulations can approve waiver requests, but **only** the head of the agency can deny a request.*[63]

These catalytic mechanisms would certainly force much thinking about the true purpose of various rules and regulations and likely lead to the elimination of

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[60] One example of a catalytic mechanism was introduced at Granite Rock, a small California gravel and cement company. Simply, their invoice reads; "If you are not satisfied for any reason, don't pay us for it." This company increases market share annually while charging a six percent price premium. See Jim Collins, "Turning Goals into Results: The Power of Catalytic Mechanisms," *Harvard Business Review*, July-August 1999, 71-3.
[61] Collins, 72.
[62] Put another way: "Make no small plans; they lack the power to move men's souls." This is the inscription placed at Union Station in Washington, D.C., by the station's architect, Cort Randall.
[63] Collins, 76.

many that had finished serving a useful purpose. The irony of this particular mechanism is that the government adopted it in 1994, but has never emphasized its use. Navy leaders need to reinstitute this idea immediately and enforce it.

Failing that, another idea is to conduct a massive review of current rules and regulations, much as the rest of the Navy has done over the past decade. While significant changes have been made in the acquisition system over the past decade[64], the level of frustration described in Chapter One shows that more work needs to be done. A new way of thinking about rules and regulations is needed. In the past, many rules and regulations responded to either criminal acts or poor performance. They were reactions. What is needed is a proactive approach.[65] Know the end state, then produce rules and regulations that help the acquisition process achieve that end state. While this sounds like high-level nonsense, when the time comes to review rules and regulations, keeping that construct in mind will force a new way of thinking.

Final Thoughts

If these proposed modifications are made, will the Navy more easily gain the three network centric warfare requirements mentioned at the chapter's start? Unequivocally, the answer is yes. IT-21 and the Navy Marine Corps intranet are current programs that will satisfy the need for a force coordination and planning network. Empowering innovation by establishing innovation cells will only

[64] For example, the Commercial Operations and Support Savings Initiative made it easier to contract commercial services and products. The Acquisition Workforce Improvement Act established requirements and standards for many key acquisition positions.
[65] Robert Younger, SPAWAR Systems Center Program Manager, telephone conversation with author, 17 May 2001.

expedite the return on this investment, both in dollars saved and increased operational effectiveness. Many Navy agencies like NAVSEA, SPAWAR Systems Center, and the Department of the Navy Chief Information Officer are instituting knowledge management initiatives. The suggested modifications will enable the rapid expansion of these initiatives to the personnel who can most use them, the fleet. Finally, the Office of Naval Research, SPAWAR, and the other laboratories are conducting basic and applied research on visualization and awareness. Even legacy programs understand that displaying information intelligently is becoming more important. Increasing flexibility for the program sponsors will give newly emerging and maturing technologies that answer a clear fleet need the chance to succeed, and also accelerate the Navy's move towards network centric operations. Acknowledging that changing rules and regulations is difficult, employing a catalytic mechanism or conducting a review can no doubt help reduce the frustration felt by the fleet and program managers daily.

In the near term, with these changes, the Navy can expect to move dramatically forward in network based operational capabilities. At some point though, the current platforms, sensors, and engagement processes will reach their technical limitations; no matter how good the network, network centric warfare as envisioned for the future will require something new. Unmanned combat vehicles, micro sensors, complex engagement networks, and deployable sensors grids will truly transform Naval operations. The current acquisition system will not bring us there.

Chapter Five: Reforming the Acquisition Process to Complete the Network Centric Warfare Dream

Introduction

Parochialism, bureaucracy, and inflexibility have riddled the current acquisition process since time immemorial. Partisan and pork barrel politics have further eroded the process. The current platform and service centric acquisition process cannot build the envisioned advanced network centric force. There seems to be no sense of urgency at the actual point of decision to make the tough calls. There is little flexibility once money is apportioned.

What is needed is the parallel to network centric warfare; a network focused acquisition approach. The whole point of network centric warfare is that it is the connections that make it work. How do we get network focused in our acquisition process? The acquisition process is split into three fundamental areas: requirements generation; budgeting; and program management. There is no quarrel with these fundamental components, but reform in each is necessary to achieve the long term 21st century network centric force stipulated by the Navy's visionary leaders. Requirements generation and the associated budgeting process must be streamlined and focused on networks. Program managers must be expected to fully capitalize on rapid technological advances, and they deserve the additional support to do so. Congress needs to be a part of the solution, not part of the problem.

Reforms will be hard; people will inherit new job descriptions or find their billet eliminated altogether. Bureaucracies will feel threatened, and indeed they should; many will be replaced or radically altered. A growing cadre of senior Navy

leaders know this change must occur, and are prepared to move forward. These reforms are for a legitimate purpose; building a network centric capable Naval force. This change can be a win-win situation, but those standing in the way will be left behind.

Joint Requirements Generation and Budgeting: Making the Hard Choices

In his book, *Lifting the Fog of War*, Admiral Bill Owens argues that a select group of civilians and military personnel, working in the Office of the Secretary of Defense (OSD), should determine all military requirements and establish the Department of Defense (DoD) budget. This OSD requirements and budgeting cadre would be mandated to build joint and network centric forces. While accepting input from the services, this cadre would have final decision making authority.[66]

Ramifications of this proposal are colossal. Does it even make sense that a few experts could do the immense amount of work necessary to balance an achievable and desirable set of requirements? Precedents for a small group developing requirements and hammering out the budget exists. Clearly, with the variety of software tools available today, it is expected that a small group of highly experienced public servants could assimilate massive input and still develop specific network focused requirements and an appropriate DoD budget that would serve the nation well. For example, Dr Andrew Marshall, head of the DoD Office of Net

[66] Owens, 354.

Assessment, has been tasked by the President to streamline the current force structure in potentially radical fashion, with the services having little to no say.[67]

Precedents already exists for a joint requirements and budgeting process conducted by a small group of knowledgeable military and civil servants. One of the lesser known results of the 1986 Goldwater-Nichols Act was the establishment of the Special Operations Command. One responsibility of that command is the generation of joint special operations requirements and budget preparation. While it has taken time, each services' special operations forces, including their personnel, are funded through this command. Today special operations forces are increasingly joint and integrated even while they retain their service identities and culture. Since 1986 the level of interoperability has grown several fold.[68]

Consider the Swedish military forces as well. Though officially neutral, this military force was very Cold War oriented. With the fall of the Soviet Union, the Swedes realized that their forces did not satisfy emerging needs. Moreover, they realized that increasing joint focus was a potential force multiplier. The Swedes commissioned a small group to engineer a totally new approach to restructuring their armed forces, including a radically new process for acquiring their future force. Despite the outrage of many senior leaders, typical of a changing environment, their recommendations were approved and are being implemented.[69] Interestingly, a group of about 100 people, including the supporting administrative staff, are all the

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[67] Thomas E. Ricks, "Pentagon Study May Bring Big Shake-Up: Unconventional Defense Thinker Conducting Review," *Washington Post*, 9 February 2001, A1.
[68] Patrick Toohey, "Special Operations Forces Overview," Lecture, U.S. Naval War College, Newport, RI: 5 April 2001.

people necessary to generate and review all Swedish military requirements and plan their military budget.[70]

Admiral Owens' suggestion is bold. Since Title X of the United States Code directs the Services to equip, train, maintain, and sustain their forces, change is needed in the public law to implement Admiral Owens' vision. This would be the perfect time for Congress to review and invigorate their oversight responsibilities as well, because with professional and well executed oversight Congress can help the DoD and the Navy achieve network centric capabilities.

Congressional Oversight as a Network Centric Warfare Enabler

The United States Constitution directs that one of the duties of Congress is "To make rules for the Government and *regulation of the land and naval forces*."[71] This oversight responsibility is an "...enormously important function of the Congress. It is at the very core of good government. Congress must do more than write the laws; it must make sure that the administration is carrying out these laws as Congress intended."[72] If properly executed, Congressional oversight can expose and prevent misconduct, discover waste, evaluate performance, and perhaps most importantly, ensure that programs conform with Congressional intent.

Too often, though, Congress' piecemeal intervention into the budgeting, requirements, and even program management processes of the current acquisition system produces mixed signals, resulting in duplication of effort, inefficient

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[68] Stefan Gustafsson, "Modernizing the Swedish Armed Forces," Lecture, U.S. Naval War College, Newport, RI: 23 March 2001.
[70] Stefan Gustafsson, Lieutenant Colonel, Swedish Armed Forces, interview by author, May 24, 2001.
[71] U.S. Constitution, art. 1, sec. 8.

spending approaches, and considerable frustration. As one former Congressman said, "Congress has given too much focus to personal investigations and possible scandals rather than programmatic review..."[73]

Reforming the requirements and budget process requires substantial change to Title X of the U.S. code. Imagine if that change included provisions for an updated process on Congressional oversight of the DoD. Both the DoD and Congress would agree upon a process that, written into law, would enable Congress to gain better oversight while streamlining the process so DoD would not duplicate effort or misunderstand what information was required. The reason to change Title X is to empower a small, joint oriented group to build an integrated military force. One responsibility of Congressional oversight in this case is to ensure that the DoD is conforming with Congress' intent that the military become more integrated. If Congress and DoD agree on streamlined methods for oversight, then Congress would gain feedback faster on DoD's progress towards this integrated state and make changes as necessary.

Therefore, in addition to the obvious Title X changes needed to initiate the OSD requirements and budgeting cadre, additionally Title X changes should incorporate at least the following oversight streamlining initiatives: 1) Establish one DoD organization which serves as Congress' single point of contact with DoD; 2) Establish an electronic tracking system for all Congressional information requests (designed to reduce duplication); 3) The DoD single point organization and

[72] Lee H. Hamilton, "Oversight: A Key Congressional Function" (remarks presented to the Congressional Oversight Workshop, 28 June 1999).

Congress agree upon a standard set of recurring reports and procedures which minimize the number of unscheduled requests for information;[74] and 4) Require Congress to establish a cost benefit measure for oversight and report that measure publicly twice a year.

Properly implemented, these initiatives would better inform Congress while reducing the administrative burden on the program managers. Further, Congress can use these routine reports to ensure that the overall mandate of the Title X changes, to grow a truly joint force, are being met. This oversight would have a profound and positive effect on the work of the new OSD requirements and budget cadre.

Reforming Program Management

Chapter Four highlighted the positive aspects of the program management component of the acquisition triad. There are negative aspects to the program management structure as well. If the network centric warfare requirements are to be realized, reforms are needed to assist the future program manager to be network centric focused.

Current program managers, both military and civilian, are motivated to succeed. There is no surprise with this, but how is that success measured? For the vast majority, delivering their product (platform) to the operator on time is the prime criteria. Remaining within their budget is the other success metric. Any other activity outside of those goals is regarded as a distraction. Program managers are

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[73] Ibid.

single track motivated and narrowly focused. The only other activity of concern is defending their budgets to their program sponsors. By the nature of the acquisition process, program managers are risk intolerant. Program managers have no motivation, in fact they are negatively motivated, to seek and consider high risk, high payoff alternatives. They have little concern for interoperability above that mandated by law, and no interest in similar systems or sub-systems being designed in sister services. Their job is difficult enough without such diversions. It is no surprise that program managers are platform centric; certainly not the right characteristic for the key implementers charged with developing and delivering the future tools of network centric warfare.

The network centric focused program manager of the future must operate under a new set of motivations. Success must be measured by how many other systems they are interoperable with, or better yet, integrated with. More is better. Expectations for program managers must be reset. While delivering their systems on time and under budget represents the epitome of success today, the bar must be raised much higher to achieve a truly integrated network centric capability. By the time most systems are designed, engineered, and delivered, the associated technology can be anywhere from three to ten years old. Program managers of the future must stay abreast of technological improvements.

Capitalizing on innovation, introducing new products, and becoming more cost effective must be the standard by which program managers are measured.

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[74] William F. Scott, et. al., "Project Kaizen Looks at Congressional Oversight of Defense Acquisition Programs," *Acquisition Review Quarterly*, Winter 1995, 87.

Turnover may increase, but weapon and sensor effectiveness and efficiencies will increase as well. This is the evaluation scheme needed for network focused program managers.

Program managers will need more help to live up to these standards. Program offices must include team members whose sole job is tracking related technologies. Larger programs may well need a full time team member to satisfy Congressional oversight report requirements. Where would the extra billets come from? The requirements and budgeting cadre approach mentioned above will free a growing number of mid to senior level officers from requirements and budget assignments for other duties. Employing them as the technology and opportunity watchdog or Congressional oversight response officer within a program office would be a well matched use of their general military talents. Moreover, it is a perfect way to launch these officers in the acquisition professional community.

Encouraging program managers to accept and manage risk, instead of avoiding it at all costs, would enable potential high payoff breakthroughs to be tried. The slush fund controlled by program sponsors recommended in Chapter Four would enable program managers to compete for additional and immediately available funding to try high payoff opportunities. Because the money could be moved immediately, these opportunities could be executed in parallel, minimizing program risk.

Consideration should be given to maximizing the number of joint program offices. The most important acquisition programs will be network oriented, and networks will have joint and coalition users. Program offices should reflect that

mixture of users. There are a few joint program offices today; they face the daunting task of defending their budgets to three separate program sponsors, limiting their flexibility and hindering their performance. As previously mentioned above, changing Title X to centralize requirements and budget authority to a small Department of Defense cadre means that funding will come from a single source, easing the joint program managers administrative burden. Joint program offices in this reformed system must be required to attain far stricter integration and interoperability standards. Because of the wide breadth of experience inherit in a joint program office, meeting these types of standards should be easier.

Final Thoughts

Jim Collins believes that organizations need, as he calls it, "one big hairy audacious goal."[75] As mentioned in Chapter Four, catalytic mechanisms are designed to assist organizations achieve their "big hairy audacious goal." These reforms are designed to enable a network centric Naval force second to none, capable of meeting all roles and missions assigned; certainly a worthy "big hairy audacious goal." Careful consideration must be given to creating the catalytic mechanisms that will enable these reforms to succeed and create a sense of urgency within DoD. One idea for a catalytic mechanism frequently mentioned is a precipitous cut in funding. There must be others as well. The important thing is that DoD leaders must establish urgency and grow support for these reforms.

One work of caution, though. Enacted immediately, these reforms would create upheaval, confusion, and backlash. DoD needs to build a plan that migrates

the current acquisition process to these new reforms gradually, using the lessons learned from the Special Operations Command and Swedish Armed Forces' experiences. Further research is needed to ensure that this migration becomes a win-win situation for all.

[75] Collins, 72.

Leading Change: Summary and Conclusions

> *[The] Office of the Secretary of Defense cannot deliver the required level of interoperability without significant change.*
>
> -Vice Admiral Arthur K. Cebrowski

In his book *Leading Change*, author John Kotter outlines fundamental steps necessary to achieve great and long lasting change. He describes corporate culture, entrenched bureaucracies, and other impediments to change and argues forcefully that not only is change necessary, but mandatory, for the overall survival of the firm.[76] Unlike many corporate enterprises, the Navy will exist as long as the United States exists; but just like those corporations the Navy faces similar impediments. Therefore, the Navy must embrace change or it is likely to be unprepared for its next test. Network centric warfare is the direction the Navy is moving towards. This was recently reemphasized by Vice Admiral Dennis McGinn, the Navy's Deputy Chief of Naval Operations for Warfare Requirements and Programs. He declared, "Our goal is to give [the CNO] a prioritized list of programs that are <u>based on the principles of network centric warfare</u>..."[77]

Attaining a truly network centric Navy will be difficult to nearly impossible to realize without changing the acquisition process. Barriers to innovation, platform centric requirements generation, and uneven Congressional oversight typify the fundamental problems that plague the current DoD acquisition system. Two strategies were proposed for making the necessary changes to ensure the Navy's

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[76] John P. Kotter, *Leading Change* (Cambridge, Mass: Harvard Business School Press, 1996), 8.
[77] Robert Holzer, "U.S. Navy Mulls Fundamental Shift in Tactics, Funds," *Defense News*, 7 May 2001, p. 1.

network centric warfare concepts achieve success. The first strategy, adjusting the current acquisition process, will provide basic networks and grant power to bottom up innovation that will jump start network centric warfare. Indeed, Dr Kotter's third principal step in leading change is to institutionalize change at the lowest level.[78] Implementing these adjustments as soon as possible must be made a top Navy priority.

Concurrently, more must be done to sell network centric warfare to the rest of the Navy. What incentive does a program manager have to promote network centric thinking? What actions does such a manager take on a daily basis to make his program more network centric? How does the senior enlisted leadership take the great ideas of his more networked minded subordinates, and apply his 20+ years of experience to actually make the idea work? Throughout the fleet the Navy needs to grow awareness at the supervisory level of the opportunities presented by the judicious application of networks.

The second and equally important step in changing the acquisition process is making the structural changes necessary to acquire the advanced and revolutionary items that will produce network centric naval forces in the future. While stalwart leadership and proper communications can accomplish the first set of adjustments, structurally changing the acquisition process will be more difficult. Fortunately, precedent for success exists.

Throughout the 1920's, the Navy revolutionized its entire organization around carrier battle groups, a warfare concept that was unproven in actual combat

[78] Kotter, 9.

until World War II. This revolution was conducted in a level or declining budget climate. The lesson is that the needed reforms can be accomplished, but it will call for perseverance and patience.

Stephen Covey suggests in his management classic, *The Seven Habits of Highly Effective People*, "Begin with the end in mind."[79] For reforming the acquisition system, Ron O'Rourke summarizes the current state of the acquisition system and a possible end state:

> *The current acquisition system can be viewed as, among other things, a huge system for avoiding errors and apportioning blame when something goes wrong. A transformed acquisition system would encourage people to take risks when appropriate and protect them from blame or criticism for errors that result from honest efforts to discover something new.*[80]

As Navy leaders work to accomplish the needed reforms, they would be wise to keep this end state uppermost in their minds; rewarding those willing to take studied risks.

Changes recommended in this paper must be integrated as part of an overall Navy effort to introduce network centric concepts and build a network centric force. This effort will include changes to our education and training process and the rapid development of tactics, techniques, procedures, and doctrine. Change in each of these areas will effect the other areas as well. Coordination and communication across the Navy will be essential.

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[79] Stephen Covey, *Seven Habits of Highly Effective People*(New York: Simon and Schuster, 1989), 25.
[80] O'Rourke, 2001, 105.

Further Research Ideas

As with any research effort, this one generated more questions than it answered. While adjusting and reforming the acquisition system will no doubt contribute to the Navy realizing a network centric force, there must be other changes that could be of benefit. One immediately come to mind. Rewrite the Federal Acquisition Regulations, known as the FAR. It is as thick as the tax code and as indecipherable. For the tax code there are thousands of accountants and tax attorneys with years of schooling on how to use that code properly and to their clients' advantage. That level of expertise is rarely found in the acquisition system, thus most program managers just muddle through, trying to avoid doing something accidental that might send them to jail. This is not the way to inspire innovation and alternative thinking.

Finally, in writing the operational example used in Chapter Two, the sensor grid emerged repeatedly as the key network centric enabler. A concern came to mind: Who will operate this complex, operationally flexible grid? Sensors will feed both intelligence specialists and combatants across all services. It is beyond the scope of this paper to address the answers, but this and other similar questions will increasingly arise. Now is the time to explore and experiment with potential answers.

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